

## ORIGINAL ARTICLE

# High prevalence of arterial hypertension in a Brazilian Northeast population of low education and income level, and its association with obesity and metabolic syndrome

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## SUMMARY

**Objective:** The objectives of this study are to estimate the prevalence of arterial hypertension (AH) in an adult population with a predominance of families with low education and income levels, in the hinterlands of Pernambuco, Brazil, and to analyze its association with other factors related to cardiovascular diseases (CVD). **Methods:** A cross-sectional study in 2008/2009 was conducted with a sample of 198 subjects stratified by age, and representative of the urban adult population of the Canaã district of city of Triunfo, in the hinterlands of Pernambuco, Brazil. **Results:** One hundred ninety eight individuals with average age of 57.7 years old (31 to 90 years-old), mainly women (65.6%), and with low income and education levels (81.3% with a monthly income of less than one minimum wage) were evaluated. Among these, 127 (64.1%) were identified as having AH, 54 (42.5%) of whom had no prior diagnosis. From those who were previously diagnosed, only 31.3% had good blood pressure control. Higher prevalence was observed in those individuals with lower incomes, higher body mass indexes (BMI), and those with metabolic syndrome (MS). **Conclusion:** These data demonstrated that there was a high prevalence of AH in the urban, low education and income levels adult population of Triunfo, strongly associated with lower income levels, elevated BMI, and the presence of MS; and a high prevalence of bad blood pressure control among the previously diagnosed cases. These results indicate that more effective interventions for early detection and adequate control of this disease and its comorbidities are necessary.

**Keywords:** Hypertension; blood pressure; cardiovascular diseases; obesity; metabolic syndrome X; epidemiology.

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## INTRODUCTION

Arterial hypertension (AH) is one of the main factors to cardiovascular diseases (CVD) and general mortality<sup>1</sup>. Generally, AH is asymptomatic, being determined by many factors such as genetic (age, race, gender, family history) and behavioral factors (smoking, obesity, alcoholism, sedentary lifestyle, stress, and excessive salt consumption)<sup>2</sup>. Among risk factors for mortality, AH accounts for 40% of the deaths by CVD and 25% of those by coronary arterial disease (CAD)<sup>3,4</sup>.

The prevalence of metabolic syndrome and type 2 diabetes mellitus (T2DM) is significantly higher in patients with uncontrolled blood pressure compared with those with controlled blood pressure. Ninety five percent of patients with both metabolic syndrome and T2DM had uncontrolled blood pressure<sup>5</sup>. It has been demonstrated that appropriate management of AH can substantially reduce morbidity, CVD mortality, and acute myocardial infarction (AMI)<sup>6</sup>. In a global analysis, the world prevalence of AH in the year 2000 was 26.4%, corresponding to around 972 million of hypertensive subjects<sup>7</sup>. In Brazil, there are an estimated 30 million hypertensive subjects<sup>8</sup>. Population database inquiries performed in certain Brazilian cities show an AH prevalence range of 22.3% to 43.9%<sup>9-12</sup>.

In the United States, cardiovascular disease is a leading cause of morbidity and mortality; therefore, prevention and treatment remain a priority for the medical community<sup>13</sup>. Even though every ethnic group and every segment of the population are affected by cardiovascular disease, it has been observed that socioeconomic and racial factors are strongly correlated with health<sup>14</sup>.

Low socioeconomic status predicts coronary heart disease independent of the traditional risk factors included in the Framingham risk score, particularly in high-income countries<sup>15</sup>.

Until now, there has been no data about this situation or even about AH prevalence in the hinterlands of Pernambuco. Therefore, this study aims to investigate the control characteristics of AH, as well as its prevalence in an urban adult population with predominant low educational status and income in the hinterlands of Pernambuco.

## METHODS

In 2008/2009, a transversal study was performed with an adult urban population of the district of Canaã in the city of Triunfo, Pernambuco, Brazil. This city is located in the hinterlands of Pernambuco's Pajeú region, 449 km from the state capital, Recife. Triunfo has a population of 15,225 inhabitants, among which 6,513 are 30 years old or more (Censo 2000/IBGE)<sup>16</sup>. It is the highest-altitude city of Pernambuco, situated in one of the arid Northeastern regions (Pajeú's hinterlands). The temperature frequently falls to 15°C, and in some occasions it can drop to 10°C. However,

the district of Canaã is situated in the lowest part of the city of Triunfo, presenting higher temperatures, similar to those typical of the hinterlands of Pernambuco. Its population of 1,817 people is typically urban, heterogeneous, with mixed-race ancestry.

The sample size, based on the number of families living in this district (234), was formed by 198 subjects and divided by age groups, in a representative way of the adult population of the city (≥ 30 years old). This research was approved by the Research Ethics Committee of the Health Science Center of the Universidade Federal de Pernambuco (CEP/CCS/UFPE) under the record 190/2006. All participants have read and signed the informed consent.

Initially, the 234 families living in that area were identified and contacted for participation in the study, and one member from each family was randomly selected. In cases where the selected member was unavailable or refused to participate, this person was replaced by the relative closest to his/her age in the family. The subjects with the following conditions were excluded from the selection: pregnancy, wasting diseases, severe psychiatric disorders, mental retardation, and the bedridden.

From 234 selected subjects, 198 concluded all steps of the study. The interviewers were properly trained and supervised by a field coordinator. The participants were interviewed according to a standard questionnaire and their answers were registered and codified with their social demographic characteristics (gender, age, education, family income), lifestyle (physical activity level, smoking) and the presence of AH, as well as other previous morbid conditions (diabetes mellitus, obesity, and dyslipidemia).

To classify the income category, the criteria of the number of minimum wages received individually per month was adopted: up to 1 minimum wage, between 1 and 2 minimum wages, and more than 2 minimum wages. For education, the criterion was based on the Law of Directives and Bases of National Education - Law 9394/96<sup>17</sup>, that uses the terms basic education (elementary and middle school), middle education (high school), and superior education (tertiary education). Those with no education were denominated as illiterate. Data about smoking and physical activity were also collected. For smoking habits, those subjects that smoked any amount of cigarettes were considered smokers, excluding those who have never smoked or those who had stopped smoking for at least 30 days. For the evaluation of physical activity, those who did not practice physical activity at least three times a week were considered sedentary.

After collecting subjective data, the anthropometry, blood pressure (BP) and cardiac frequency of the subjects was measured, and they were instructed to fast for 12 hours in order to take a blood test in a Basic Unit of Health (Unidade Básica de Saúde - UBS), for biochemical determinations.

To evaluate the glucose tolerance, all subjects were initially tested with capillary fast glycemia (CFG) in field, during the following days of the interview. The diagnoses of DM, impaired glucose tolerance (IGT) and impaired fasting glycemia (IFG) were based on the Brazilian Diabetes Society's criteria<sup>18</sup>. Thus, besides those previously diagnosed with T2DM, the following were considered diabetic: those with fasting blood glucose  $\geq 126$  mg/dL in two different occasions; or those with glycemia  $\geq 200$  mg/dL two hours after the oral glucose tolerance test (OGTT) with 75g of glucose. The OGTT was performed in all subjects who presented fasting capillary glycemia between 100 mg/dL and 125 mg/dL, as well as in one out of six subjects presenting fast glycemia  $< 100$  mg/dL. For those with capillary glycemia  $\geq 126$  mg/dL, the exam was confirmed with blood glucose in the health unit of reference. For the previously known cases of T2DM, the evaluation of the glycemic control was done with the last result of glycohemoglobin A1c in the health unit chart obtained by revision (related to this study period).

BP was measured three times, with two-minute intervals, in the right arm of each subject, after at least five minutes of rest, seated, using an electronic and digital validated oscillometric blood pressure monitor (Omron 705CP, Dupont – Paris, France)<sup>19</sup>. The average of the three measures was used. The diagnosis, as well as the AH control of subjects with previous diagnosis of AH, were based on the criteria of the Brazilian Cardiology, Hypertension and Nephrology Society<sup>2</sup>: systolic BP  $\geq 140$  mmHg and/or diastolic  $\geq 90$  mmHg, and those who previously used antihypertensive drugs. For the diagnosis of metabolic syndrome, the criteria recommended by the International Diabetes Federation (IDF) were used<sup>20</sup>. For the diagnosis of overweight or obesity, the criteria used was the body mass index (BMI), determined by the ratio of weight (in kg) and the square height (in meters). BMI  $< 18.5$  kg/m<sup>2</sup> was considered underweight; BMI between 18.5 and 24.9 kg/m<sup>2</sup>, normal; and BMI  $\geq 30$  kg/m<sup>2</sup>, obese<sup>21</sup>.

The portable blood glucose monitoring system used was the Accu-Check (Roche). The determination of blood glucose, total cholesterol, HDL cholesterol, and triglycerides were performed by colorimetric method (Hitachi 917R Roche device).

The distribution and homogeneity of the groups were analyzed by gender, age, income, education, smoking, sedentary lifestyle, BMI, T2DM, and metabolic syndrome. In the statistics analysis, the chi-square ( $\chi^2$ ) method was used to compare proportions, with a confidence interval (CI) of 95%, considering a level of significance of 5% ( $p \leq 0.05$ ).

## RESULTS

In this population, 127 hypertensive subjects were identified, representing a prevalence of 64.1% (CI 95%: 57.4-70.7%). Among them, 73 subjects (57.5%) presented a previous diagnosis of AH, while 54 (42.5%) had no knowledge of being hypertensive. Among those with previous diagnosis, only 31.3% had BP  $< 140/90$  mmHg.

The average age of the subjects in this study was 57.4 years (31 to 90 years), with predominance of women (65.6%), and low income and education levels. Table 1 exhibits their distribution by age and gender.

The individual analysis by gender has shown a significantly higher relative prevalence of AH (reported and observed) in women (70.8%) when compared to men (51.5%) ( $p \leq 0.01$ ). According to the evaluation by age range, there was a positive relation between age range and the presence of AH in men as well as in women ( $p < 0.01$ ) (Table 1).

In Table 2, the prevalence of AH is presented according to the education level and the individual monthly income level. There was an important difference among the several levels of income. The prevalence of AH was higher in the less than one minimum wage level ( $p \leq 0.05$ ). However, such differences were not observed among the distinct levels of education.

**Table 1** – Prevalence (%) of arterial hypertension (AH) in the population of Canaã/Triunfo (PE, Brazil) and its distribution by gender and age

Age (years)	Male			Female		
	n	%	CI (95%)	n	%	CI (95%)
30-39	6	33.3	(00.0-71.0)	11	36.4	(7.90-64.0)
40-49	14	35.7	(10.6-60.7)	23	56.5	(36.2-76.7)
50-59	22	59.1	(38.5-79.6)	37	75.7	(61.8-89.5)
60-69	14	64.3	(39.2-89.3)	29	75.9	(60.3-91.4)
$\geq 70$	12	50.0	(21.7-78.2)	30	83.3	(69.9-96.6)
Total	68	51.5	(39.6-63.3)	130	70.8	(62.9-78.6)

% total of AH: 64.1% (57.4 - 70.7)

n, absolute number of subjects; CI, confidence interval of 95%.

**Table 2** – Prevalence of arterial hypertension (AH) in the population of Canaã/Triunfo (PE, Brazil) according to education level and individual monthly income

Characteristic	General distribution in the sample (%)	% of AH	CI 95%	*p
Education level				0.591
Illiterate	13.1	73.9	55.9-91.8	
Basic Education	80.0	67.1	59.3-74.8	
Middle Education	6.9	58.3	30.4-86.1	
Monthly income				< 0.05
< 1 minimal wage	81.3	68.9	61.7-76.0	
1-2 minimal wages	16.7	42.4	25.5-59.2	
> 2 minimal wages	2.0	50.0	1.00-99.0	

\* Test  $\chi^2$ , significance level of 5% ( $p < 0.05\%$ ).

Analyzing the distribution of AH prevalence and according to the presence of other cardiovascular risk factors (Table 3), a relation among occurrence of AH and sedentary lifestyle, smoking, or T2DM was not observed. However, a higher prevalence of AH was observed in those groups presenting higher BMIs, and in those with metabolic syndrome (MS) ( $p < 0.01$ ).

## DISCUSSION

This study is part of a bigger proposal that aims to describe the epidemiological and genetic aspects related to cardiovascular risk factors in a population of the hinterlands of Pernambuco<sup>22</sup>. The population of the district of Canaã

was chosen for properly representing the typical population of the hinterlands of Pernambuco. Canaã, which is situated in the lowest part of Triunfo, presents higher temperatures than the average temperature of the city, resembling the climate and social economics characteristics found in the rest of Pernambuco's hinterlands. Hence, the findings of this study are probably representative of urban populations of small cities, with mixed-race ancestry and predominance of low income and education levels in the northeastern hinterlands.

In this study, an AH prevalence of 64.1% was identified in this population. Such a finding shows a high proportion of subjects with this diagnosis, being much

**Table 3** – Prevalence of arterial hypertension (AH) in the population of Canaã/Triunfo (PE, Brazil) distributed according to other cardiovascular risk factors (smoking, sedentarism, body mass index [BMI], type 2 diabetes and metabolic syndrome)

	General distribution in the sample (%)	% of AH	CI 95%	p
Smoking				0.196
Yes	28.2	76.0	64.0-87.9	
No	71.8	65.3	56.9-73.6	
Physical activity				0.818
Yes	27.8	70.9	57.6-84.1	
No	72.2	68.9	60.5-77.2	
BMI (kg/m <sup>2</sup> )				< 0.01
< 20	10.1	44.4	21.4-67.3	
20-24.9	38.5	58.0	46.3-69.6	
25-29.9	35.8	75.0	64.3-85.6	
≥ 30	15.6	78.6	63.4-93.7	
T2DM				0.813
Yes	13.6	68.0	49.7-86.2	
No	86.4	64.2	56.7-71.6	
MS				< 0.01
Yes	48.5	82.3	74.6-89.9	
No	51.5	47.1	37.4-56.7	

BMI, body mass index; MS, metabolic syndrome; T2DM, type 2 diabetes.

greater than the prevalence found in previous studies conducted in different populations. The world average prevalence of AH is 26.4%, with high variation according to the studied population, from 33.5% to 39.7% in European countries; 15% to 21.7% in African and Asian countries; and about 40% in Latin American countries<sup>23</sup>. The Brazilian Hypertension Society estimates that there are 30 million hypertensive subjects in Brazil, representing around 30% of the adult population<sup>2</sup>. Population basis inquiries performed in some cities of Brazil showed a prevalence of AH ( $\geq 140/90$  mmHg) from 22.3% to 43.9%<sup>9-11</sup>. A study also performed in the Northeast region registered an AH prevalence of 27.4%, evaluating subjects with average age of 39.4 years in São Luis (MA)<sup>12</sup>. Therefore, the findings of this study, which is the first one with this objective in a Pernambuco's hinterlands population, probably reveal a severer situation in this field.

Nonetheless, it is known that in elderly subjects AH is even more prevalent, affecting more than 60% of those subjects over 65 years old<sup>24,25</sup>. In this study, there was also significant increase in the proportion of hypertensive subjects in the higher age ranges, the highest prevalence presenting in those over 60 years old. This, as well as the fact that 43% of the subjects of the sample were 60 years old or more (average age of 57.5 years), could justify the higher prevalence of AH observed in this population.

In global estimates, there are no significant differences between AH prevalence in men (26.6%) and in women (26.1%)<sup>8</sup>. A study with hypertensive adults of São José do Rio Preto is in accordance with this data, not evidencing differences between men and women<sup>26</sup>. However, differences in these proportions can be observed when considering different age ranges, being higher for men until 50 years old and for women over 60 years old<sup>27</sup>. In this study, the prevalence of AH was higher in women, this data being attributed to a great proportion of this gender in the higher age ranges.

Among the hypertensive subjects, a high proportion had not been previously diagnosed. Among those with previous diagnosis, around two thirds had BP above the recommended levels<sup>10</sup>. The great number of patients in these conditions demonstrates a lack of systematic measures for adequate detection and the little effective attention to those patients.

The socioeconomic characteristics the educational status play an important role in the health conditions among many factors, such as access to health system, level of information, and treatment comprehension<sup>28</sup>. A study performed in Brazilian capitals and in the Federal District demonstrated that 25.1% to 45.8% of hypertensive subjects had an incomplete basic education<sup>29</sup>. The population of the present study had a predominance of

subjects with low education level; however, there was no difference in the AH prevalence when comparing different groups according to the level of education. Such fact could be due to the small number of those with higher level of education. The proportion of hypertensive subjects was higher among those in the lower income level (less than one monthly minimum wage).

In this study, a higher prevalence of AH was also observed in those subjects with higher BMI levels, where more than 2/3 of the overweight or obese were hypertensive. Such morbid conditions are well established risk factors for AH, as demonstrated in previous Brazilian works<sup>12,30</sup>. Around 75% of men and 65% of women presented arterial hypertension directly attributed to overweight or obesity<sup>8</sup>. In the present study, most subjects with MS were also hypertensive. Other Brazilian studies show similar results. In a study with 102 hypertensive subjects over 18 years old in a teaching hospital in Salvador-BA, a MS prevalence of 71.6% (NCEP-ATP III criteria)<sup>31</sup> was registered. Another study, performed in Cuiabá, composed by a sample of 120 hypertensive subjects with average age of 58.3 years, registered a MS prevalence of 70.8%<sup>32</sup>.

Arterial hypertension and diabetes, when together, increase the risk of lesions in target organs, incidence of CVD, and mortality<sup>33,34</sup>. AH is associated with a double risk for developing T2DM<sup>35</sup>. Moreover, the prevalence of this abnormality in patients with T2DM is one to three times higher than in non-diabetics with similar age and gender<sup>36,37</sup>. However, in the present study a similar proportion of AH in diabetics and non-diabetics subjects was detected. Possibly, this finding is due to other factors, not approached in this research, although it should be considered that there was a high proportion of hypertensive subjects in both groups, with more than 60% of subjects affected.

Smoking still represents an important public health problem, in spite of its tendency towards reduction observed in the last years<sup>35</sup>. In accordance to this tendency, in the present study there was a higher proportion of non-smokers in the sample, but there was no difference in the prevalence of AH among smokers and non-smokers. Such data resemble that reported in other Brazilian epidemiologic studies<sup>38,39</sup>.

In summary, those findings demonstrate a high prevalence of AH in an urban adult population of low income and education levels in the Brazilian Northeastern hinterlands, associated to lower income levels, higher BMI levels and presence of MS, besides a high prevalence of poor blood pressure control among previously diagnosed cases. Such results indicate the need for more effective approaches, especially in the socioeconomic level featured in this study.



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